

APPLICATION OF SPECIFIC NAMES AND ASSOCIATION OF SEXES
IN *CADEGUALINA* MICHENER (HYMENOPTERA:
COLLETIDAE: DIPHAGLOSSINI)

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Abstract.—Males and females of the Andean genus *Cadegualina* Michener are associated for the first time from the same place, in the eastern Andes of Colombia. They are probably *C. sericata* (Friese), **new combination**, resurrected from probable synonymy under the only other species, *C. andina* (Friese). *Cadegualina sericata* is described in full, as is its variable melanism in females. A female of presumed *C. andina*, hitherto known only from males, is also described. Males of *C. sericata* can be separated from *C. andina* by the shape of the apical pilose lobe of sternum seven, the shape of penis valve, and the shape and pubescence of the gonostylus in the genitalia; females can be distinguished by the projecting posterodistal angle of the hind basitarsus and second tarsomere.

Resumen.—Machos y hembras del género andino *Cadegualina* Michener son asociados por primera vez del mismo lugar en la cordillera Oriental de Colombia. Probablemente corresponden a *C. sericata* (Friese), **nueva combinación**, cuyo nombre es resucitado de una probable sinonimia con la única especie, *C. andina* (Friese). *Cadegualina sericata* es descrita completamente, así como el melanismo variable de las hembras. También se describe una hembra, aparentemente de *C. andina*, especie hasta ahora conocida de machos. El macho de *C. sericata* se puede separar de *C. andina* por la forma del lóbulo apical piloso del esterno siete, la forma de las valvas peneales y la forma y pubescencia del gonostilo de la genitalia; la hembra se puede reconocer por el ángulo posterodistal proyectado del basitarso posterior y segundo tarsómero.

Key Words: Apoidea, Andes, *Cadegualina*, taxonomy, Colombia, melanism

Michener (2000a) recently pointed out that the least known bee fauna in the world is that of the higher Andes, from Perú to Venezuela. The genus *Cadegualina* Michener (Colletidae, Diphaglossini) is one example about which almost nothing is known. The genus seems to occur above 2500 m from Bolivia to Venezuela, and consists of hairy, robust, middle-sized bees (10–12 mm) with an elongated malar area,

an obliquely truncated apex of the marginal cell, and a reduced third submarginal cell. Sternum seven of the male has a small body, almost without the apical lobes found in most colletids. *Cadegualina*, as previously recognized, superficially resembles fulvous-haired specimens of *Cadeguala occidentalis* (Haliday) from Chile, but it is probably more closely related to another Chilean diphaglossine genus, *Diphaglossa*

Spinola, as suggested by the similarity of the male genitalia and reduced third submarginal cell (Michener 1986, 2000b). Commonly bees with elongate heads as in *Cadegualina* are thought to be adapted for tubular flowers; however, no behavioral observations are available to test this hypothesis for *Cadegualina*. Nests and immatures of *Cadegualina* remain unknown.

Until now, *Cadegualina* has been known from only four specimens: A) Two males, the types of *C. andina* (Friese), from an unknown locality in Venezuela; one of them designated as the lectotype by Michener (1986) (for more about the locality, see Michener 1986). B) One male from Tarata, Bolivia, included in *C. andina* by Friese (1925), that has not been found in spite of a search at the presumed depositary in Berlin (F. Koch, personal communication). Since we now know that at least two species exist (see below), the specific identity of the Bolivian specimen, which we have not seen, must be considered unknown. C) Finally, one female, the type of *C. sericata* (Friese), labelled Guayaquil, Ecuador. Guayaquil is at sea level, but other high Andean bees described by Friese were labelled Guayaquil (Michener, in prep.). We therefore assume that this specimen also came from somewhere in the Ecuadorian Andes. Of course there is no way to determine if this female belongs to the same species as the male type of *C. andina*. Friese (1925) suggested this possibility, and Michener (1986) listed *C. sericata* as a questionable synonym of *C. andina*.

We recently examined males and females of *Cadegualina* collected for the first time for the genus at the same time and place, in the eastern Andes of Colombia. The male differs from the type of *C. andina* in sternal and genitalic characters; hence, the species is not *C. andina*. The female agrees with the female from "Guayaquil", the type of *C. sericata*, in the hind tarsal character that differentiates this species from a female that may be properly associated with male types of *C. andina*. We therefore recognize and

describe in full both sexes of *C. sericata* (Friese), **n. comb.** The female of the presumed *C. andina* is also described.

MATERIALS AND METHODS

The morphological description and illustrations were made using an Olympus SZ microscope. The description format and morphological terminology follow Michener (1986) and terminology for surface sculpturing follows Harris (1979). Setal length is given relative to the diameter of the median ocellus. The abbreviations F, S, OD, and T are used for flagellomere, metasomal sternum, ocellar diameter, and metasomal tergum, respectively. Measurements are given with standard errors. Specimens are placed in the following institutions:

- LABUN Laboratorio de Investigaciones en Abejas, Universidad Nacional de Colombia, Santa Fé de Bogotá, AA. 14490, Colombia (G. Nates-Parra).
 MNHV Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (F. Koch).
 SEMC Snow Entomological Division, Natural History Museum, University of Kansas, Lawrence, KS, 66045-7523, USA (Z. Falin).

Cadegualina sericata (Friese),
new combination
 (Figs. 1–7)

Bicornelia sericata Friese 1925: 11 (holotype female, MNHV).

Cadegualina andina: Michener 1986: 188 (part).

Diagnosis.—Males can be separated from *C. andina* by the shape of the apical pilose lobe of S7 (Fig. 2), shape of penis valve, and shape and pubescence of the gonostylus in the genitalia (Fig. 5) (compare with Michener 1986, figs. 17–20); females of *C. sericata* can be distinguished by the projected posterodistal angle of the hind

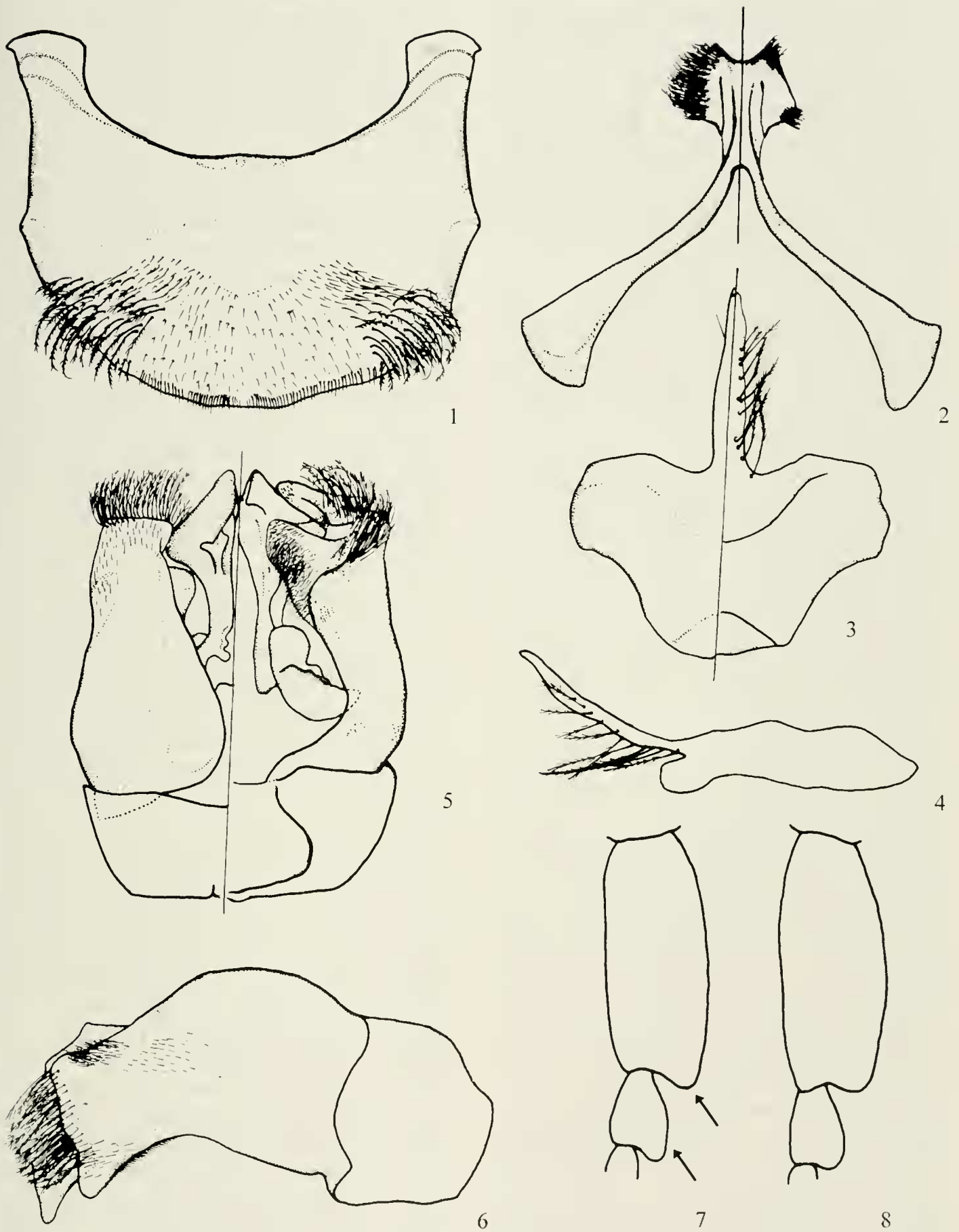


Fig. 1-8. Male genitalia and hind basitarsus of *Cadegualina*. 1-7, *C. sericata*. 8, *C. cf. andina*. 1, S6, ventral view. 2-3, S7-S8, dorsal (left) and ventral (right) views. 4, Lateral view of S8. 5-6, Genital capsule, dorsal (left), ventral (right) and side views. 7-8, Hind basitarsus and second tarsomere of the females of *C. sericata* and *C. cf. andina*, respectively.

basitarsus and of the next tarsomere (Fig. 7).

Description.—*Male*: Body length 12.3 mm; forewing length 9.8 mm. *Structure*: Superior interorbital distance 0.8 as long as inferior interorbital distance; interantennal distance 1.3 times as long as alveolorbital distance; interocellar distance about as long as ocellocular distance; ocelloccipital distance about 1.3 times diameter of median ocellus; distance from median to lateral ocellus about half diameter of median ocellus; malar area 1.7 times as long as broad, about one-third of compound eye length in lateral view; head 1.1 times as wide as long; labrum triangular, convex, gently tumescent midbasally, slightly wider than long; clypeus about as long as broad, projecting about 0.8 compound eye width in lateral view; clypeus medioapically with shallow, broad (OD) emargination; compound eye 2.4 times as long as broad; gena about 0.7 times compound eye width in profile; scape 2.8 times as long as broad, F1 about as long as broad, 0.7 length F2, F2 1.5 times as long as broad, F3 1.4 times as long as broad; mandible with small preapical tooth. Triangle on posterior surface of propodeum delimited by ridge or carina that extends up to midpoint of posterior propodeal surface. Second recurrent vein of forewing about 2 vein widths before third submarginal cross-vein; marginal cell length 1.4 times the distance from its apex to wing tip; right hind wing with row of 15 hamuli, left wing with 15 and one isolated hook. Front and middle legs unmodified; hind basitarsus about 2.5 times as long as broad, slightly less than half hind tibial length, with posterior margin gently convex. Genitalia and associated sterna as in Figs. 1–6. *Coloration*: Integument black, except labrum brownish, pronotum and apical half of mandible dark reddish brown; anterior pronotal margin yellowish cream; front tibia, tarsi, tibial spurs and bases of pretarsal claws of all legs brownish, remainder of legs dark reddish brown; tegula translucent dark reddish brown; wings translucent dusky, clearer to-

ward apices, veins dark brown to black; metasomal terga dark brownish black, posterior margins broadly translucent brown; metasomal sterna dark brown, basal parts blackish. *Pubescence*: On head mainly yellowish white; margins of labrum with short ($< OD$), stout, simple, ferruginous setae, longer toward apex; malar area nearly hairless, except median longitudinal area with sparse, very short and fine setae; clypeus with a premarginal fringe of long (3 OD), simple, pale ferruginous setae as on outer margin and condylar groove of mandible; lower and lateral marginal paraocular area densely covered (integument not visible) with short ($< OD$), appressed, white, branched setae; upper paraocular area, frons, vertex, preoccipital margin, and along outer orbital margin with long ($> 3 OD$), sparse, erect, dusky, branched setae, those on upper face arising among whitish short pubescence, longest ($\geq 4 OD$) and denser on vertex and preoccipital margin; clypeus and supraclypeal area densely covered (integument barely visible) with long (3 OD), branched, dusky setae, longest and denser on latter; outer surface of scape with long, branched, dusky setae, longest setae about 1.6 times as long as maximum width of scape; gena with yellowish white setae as on clypeus, longest ($> 6 OD$) and denser on lower gena and hypostomal area. Mesosoma, except for bare basal area of propodeum, densely covered (integument of scutum barely visible) with long (5–6 OD), branched, yellowish setae as on gena; outer surfaces of femora, tibiae and basitarsi of all legs, and inner surfaces of hind and middle tibiae with dark brown setae; inner surface of front tibia, and inner and outer surfaces of mediotarsi and distitarsi of all legs with ferruginous setae, remainder of legs with yellowish setae as on mesoscutum. T1 with long ($> 3 OD$), sparse, erect, branched, yellowish setae; T2–T3 densely covered with short ($\geq OD$), erect, branched, black setae, except for sides of T2 with long, yellowish setae as on T1; T4–T7 with branched, blackish-ferruginous setae (> 2

OD); shorter ferruginous setae on inner surface of hind basitarsus, longer on sides of T5 and T6, remainder of these terga mostly with simple setae, T7 with mostly simple, shorter (\geq OD) and denser setae on apical margin. Apical margins of S1–S4 with long (> 2 OD), branched, mostly anteriorly curved, ferruginous setae as on T4. *Puncturation*: Labrum weakly imbricate; clypeus with strong punctures, as close as they can be except preapical area smooth and shiny; paraocular area with stronger and denser punctures (< 1 puncture widths) than on clypeus, integument between punctures micropunctate-lineolate; malar area smooth and shiny; supraclypeal area with coarser, denser punctures, less punctuate above antennal socket; vertex with sparse punctures (> 3 puncture widths), weakly imbricate, shiny as on gena. Mesosoma with faint punctures separated by 2–3 puncture widths, integument imbricate to micropunctate-lineolate. Metasoma with sparse punctures separated by 2–3 puncture widths, integument otherwise weakly imbricate to micropunctate-lineolate.

Female: As described for male except for ($n = 4$): body length 13.7 mm (± 0.2); forewing length 10.1 mm (± 0.1). *Structure*: Superior interorbital distance 0.7 as long as inferior interorbital distance; interantennal distance about as long as alveolar distance; ocelloccipital distance about 1.2 times diameter of median ocellus; malar area about 1.4 times as long as broad; head 1.2 times as wide as long; clypeus wider than long (about 0.9 times as long as wide), projecting more than half compound eye width in lateral view; compound eye 2.9 times as long as broad; gena about as broad as compound eye width in profile; scape 3.8 times as long as broad, F1 1.2 times as long as broad, F2 and F3 about 1.3 times as long as broad; mandible with two small preapical teeth. Carina delimiting triangle on posterior surface of propodeum more pronounced and sharper than in male. Second recurrent vein of forewing about one to three vein widths before second sub-

marginal crossvein; marginal cell length 1.3 times the distance from its apex to wing tip; left hind wing with a row of 17 hamuli, right with 16 and one isolated hook. Hind basitarsus and next tarsomere with posterodistal angles projected as in Fig. 7, hind basitarsus about 0.6 times hind tibial length. *Coloration*: Integument black as in male, except for malar area, disc of clypeus, lower parts of posterior surface of propodeum and metepisternum, and all legs dark brown. *Pubescence*: On head mainly dark brown; paraocular area with longer (\geq OD), branched, yellowish setae, sparser than in male, longer (> 2 OD) and denser on supraclypeal area; clypeus with short (about OD), semierect, branched, sparse yellowish setae (integument visible); long (> 2 OD), branched, dark brown setae arising among yellowish setae on clypeus, such dark setae denser than in male; upper gena with mostly brownish dusky setae, lower gena with longer (> 4 OD), branched, yellowish setae; scape with branched, short (equal or shorter than scape maximum diameter), dusky setae. Thoracic setae and those of leg bases (coxae to femora), and T1 variable (see Variations below). Remainder of legs covered with dark brown setae or black on outer sides of tibiae and basitarsi; hind femur and tibia with dense and well-formed scopa. T2–T3 densely covered with rather short (about OD), branched, black setae; T4 and T5 with rather appressed, branched coppery setae. T6 covered with branched, dark brown setae, setae longer (≥ 3 OD) on lateral sides. S1 densely covered with long (> 3 OD), branched, brownish or dusky setae; apical margins of S2–S5 with long, erect dusky to brownish fringes, discs of these sterna and S6 with short hairs (\leq OD). *Puncturation*: Apical half of labrum with stronger punctures than in male, punctures separated by one puncture width, integument strongly imbricate; clypeus with strong punctures throughout, separated by ≤ 1 puncture width. Metasoma in general more finely punctuate than in male, sterna

with punctures stronger and more scattered (2–3 puncture widths) than terga.

Material examined.—COLOMBIA: 1 ♂, 3 ♀, Boyacá, Tunja, Santuario de Fauna y Flora de Iguaque [5°70'N, 73°46'W], Carrizal Creek, January 8 1992, 2830 m, C. Sarmiento Coll. 1 ♀, Cundinamarca, La Calera [4°43'N, 73°58'W], November 12 1983 [2800 m], G. Nates Coll. (LABUN, SEMC).

According to their collector (C. Sarmiento, personal communication), all three females and the male from Boyacá were caught at the same nest site, and all were collected in the dry season. The females have pollen on their scopas, indicating that they were actively provisioning nests; however, *Cadegualina* adults may fly at other seasons as indicated by the *C. cf. andina* female (see below), with worn wings and mandibles, collected on July 21, in the central Andes.

Variations.—The four known females from the eastern Andes of Colombia vary greatly in pile color, even among the three specimens from the same locality in Boyacá. The following comments concern the specimens from Boyacá except as indicated for the specimen from Cundinamarca. One specimen (1) has the long, dense setae of the thorax, leg bases (coxae to femora) and T1 entirely fulvous, paler on the sides of the thorax and leg bases than on the dorsum, the femoral scopa whitish with some dusky admixture. This is much as in known specimens of *C. andina*. At the opposite extreme in coloration is a specimen (2) with the setae of the areas listed above black, somewhat dusky on the propodeum, femoral scopa and T1, but with a patch of bright fulvous just below the tegula and wing bases, grading into brownish dusky on the lower mesepisternum. An intermediate specimen (3) (in bad condition with many setae in many areas matted) has the setae of the areas listed largely black, but somewhat dusky on posterior part of scutum, scutellum, sides of thorax, propodeum and T1, brownish dusky on outer side of fem-

oral scopa, dull whitish on inner side of femoral scopa; patch below tegula yellowish white. The specimen from Cundinamarca (4) is also intermediate, with the setae on the areas listed black with some dusky intermixed, on posterior lateral angles of scutum and scutellum and metanotum pale fulvous, on lower part of mesepisternum dusky fulvous, on rest of side of thorax and on propodeum and T1 dusky; femoral scopa almost entirely white. The setae below the tegula and wing bases are black so that there is no patch as in specimens 2 and 3.

Another variation is in wing venation. In female number 4, the third submarginal cell is much narrowed toward the anterior wing margin, so that cell is almost triangular, while in specimens 1 to 3 and in the male the cell is about half as wide on the anterior margin as on the posterior margin. Also in number 4 the second recurrent vein meets the third submarginal crossvein on the left wing; on the right wing they are separated by about one vein width. In the other specimens the veins are separated by two or three vein widths.

Comments.—The male described above differs from the type of *C. andina* in the sternal and genitalic characters as stated in the diagnosis. The female agrees with the type of *C. sericata* [CDM examined that type in 1984 and Frank Koch kindly checked the hind tarsal character that differentiates *C. sericata* from a female that may be properly associated with male types of *C. andina* (see below)]. This hind tarsal character (Fig. 7) is rather weak, and males from Ecuador, more certainly associated with the female type from "Guayaquil", would help to verify our use of the name *C. sericata*.

Interestingly, *Cadeguala occidentalis* of Chile and neighboring countries also exhibits melanism, principally evident among females. There is no evidence that the black-haired females named *Cadeguala tetra* (Spinola) are a different species from the common fulvous-haired individuals (Michener 1986).

Cadegualina andina (Friese)
(Fig. 8)

Bicornelia andina Friese 1925: 12 (lecto-type male, MNHV); Snelling 1980: 3.
Cadegualina andina: Michener 1986: 188 (part).

Description.—*Female*: As for *C. sericata* except as follows: body length 14 mm; forewing length 10.6 mm. *Structure*: Second recurrent vein of forewing about three vein widths before second submarginal crossvein; left hind wing with row of 18 hamuli and two isolated hooks; right with 16 and two isolated hooks. Hind basitarsus and next tarsomere with posterodistal angles broadly rounded as in Fig. 8. *Coloration*: Leg bases (coxae to femora) dark brown, remainder of legs brownish. *Pubescence*: Thorax, legs bases and T1 with yellowish setae, scutum with some dusky setae intermixed; remainder of legs with brownish setae. T2–T3 with mostly dusky setae intermixed with yellowish to coppery setae, especially along apical margin of T3.

Material examined.—COLOMBIA: 1 ♀, *Quindío*, Salento, Valle de Cocora, Reserva Herencia Verde, 2950 m, July 21 1998, S. Sendoya Coll. (LABUN).

This female was collected while presumably entering the nest in the ground. The nest entrance was 8 mm in diameter. A female of the Sphecid wasp *Podagrityus* Spinola (Cabroninae) was also captured leaving the same nest (S. Sendoya, personal communication).

Comments.—Our recognition of the female for *C. andina* is extremely tenuous. It is based on a single female from the central Andes of Colombia that differs slightly from the females called *C. sericata*. We therefore consider that it may be the female

of the only other named species, *C. andina*. The female described above has a lighter pubescence on the body, similar to lighter specimens of *C. sericata*. It differs primarily from *C. sericata* females by the posterodistal angles of the hind basitarsus and next tarsomere; such angles are projecting and acute in *C. sericata*, broadly rounded in the presumed *C. andina* (Fig. 8).

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